REMARKS

Claims 1-28 are pending in the present application.

In the office action mailed June 1, 2005 (the "Office Action"), claims 1, 2, 7-9, 14-16, 19, 21-24, and 27 were rejected by the Examiner under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,482,161 to Sumanaweera *et al.* (the "Sumanaweera patent"). Claims 3-6, 10-13, 17, 18, 20, 25, 26, and 28 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

The specification has been amended to include a statement of governmental interest and to conform the summary to the subject matter of the pending claims.

Applicants would like to bring the Examiner's attention to a Petition to Accept Color Drawings or Photographs under 37 C.F.R. § 1.84(a)(2) and (b)(2) ("Petition"), which was filed with the Patent Office on January 14, 2004. A decision on the Petition has not yet been received. Applicants request the Examiner to consider the Petition and respond accordingly.

Claims 1, 2, 5, 6, 7, 8, 14, 19, 21, 22, 27, and 28 have been amended to more clearly recite the claimed subject matter. It will be apparent from the amendments, and the comments below, that the amendments were made independent of the cited references. None of previously mentioned amendments narrow or further limit the scope of the invention as recited by the respective claim. Generally, the amendments make explicit what is implicit in the claim, add language that is inherent in the unamended claim, or merely redefine a claim term that is previously apparent from the description in the specification. Consequently, the amendments should not be construed as being "narrowing amendments," because these amendments were not made for a substantial reason related to patentability.

Claims 1, 7, 14, and 22 are patentably distinct from the Sumanaweera patent because the Sumanaweera patent fails to disclose the combination of limitations recited by the respective claims.

The Sumanaweera patent is directed to an ultrasound system for constructing a three-dimensional ("3D") image of a vessel structure. The system additionally automatically analyzes the vessel structure to identify constrictions and for medical diagnosis. The 3D image of a vessel, the particular example described in the Sumanaweera patent being the carotid artery, is constructed by a 3D image processor 114 by taking information from several two-dimensional

("2D") data frames of the vessel and constructing a 3D grid therefrom. Intermediate points in between the 2D data frames are interpolated from existing data points to construct the 3D image. *See* col. 5, lines 14-28. In an alternative embodiment, spaced line data are used to interpolate the 3D grid from which the 3D image is constructed. *See* col. 5, lines 29-35.

Analysis of the vessel structure is based on identifying a "center axis" of a vessel, which corresponds to a center of flow for the vessel. *See* col. 6, lines 12-16. In determining the center of flow, ultrasound data representing the vessel is obtained for the region of interest. Examples of the types of data include Doppler energy and velocity data, and ultrasound data identifying the vessel and end points of the vessel. *See* col. 6, lines 41-43 and col. 7, lines 1-21. Data associated with vessels other than that of interest are removed from the vessel analysis. One technique for doing this is by analyzing the direction of flow or hemodynamics of the vessels. Data for vessels other than that of interest can be removed where the direction of flow is different than that expected for the vessel of interest. For example, where data for both the jugular vein and the carotid artery are present, the system described in the Sumanaweera patent can remove data for the jugular vein given user input (identifying the carotid artery as the vessel of interest), and a known orientation of the ultrasound transducer. *See* col. 7, lines 22-35. Examples of hemodynamics that can be used for removing data related to a vessel other than that of interest include steady flow versus pulsatile flow, different flow cycles, speed of flow, volume of flow, and area of flow. *See* col. 7, lines 42-52. Using the data acquired for the vessel of interest, the center flow of the vessel is determined from a process of calculating a magnitude of the local gradients and using the same for iteratively dilating the vessel. The center flow is identified by the dilation. *See* col. 7, line 53-col. 8, lines 52.

The system described in the Sumanaweera patent further automatically divides flow between two vessels from a vessel bifurcation. *See* col. 8, lines 55-61. The process involves obtaining data representing the bifurcated vessel and calculating a division of flow from a common portion of the bifurcated vessel. *See* col. 8, lines 62-67. The Sumanaweera patent describes dividing the flow by calculating a ratio of an integral of the ultrasound data for a cross-section of a first branch to an integral of the ultrasound data for a cross-section of a second branch. *See* col. 9, lines 36-43. The ratio represents the amount of flow from the common area attributable to each branch. *See* col. 9, lines 50-56. In an alternative embodiment, the division of

flow is calculated by using the intersection of two or more planes that are perpendicular to the center axes of the branches within the common portion of the vessel. *See* col. 10, lines 23-46. The ultrasound data associated with spatial locations or the area on each side of the intersection is segmented between the two branches as a function of the intersection. *See* col. 10, lines 47-55.

With respect to claim 1, the Sumanaweera patent fails to at least disclose a processor operable to calculate blood flow data for a plurality of locations along the ultrasound beam axis and for a plurality of time intervals. As previously discussed, the ultrasound system described in the Sumanaweera patent is directed to creating a 3D image of a vessel structure and for automatic vessel structure analysis, including flow in the vessel. As such, the data used for constructing the 3D image is related to *spatially* arranged 2D planes representing the physiology of the vessel. The vessel structure analysis performed by the system described in the Sumanaweera patent relies on data, such as Doppler energy or velocity data, at spatial locations within the vessel. From that data, the magnitude of local gradients are calculated for the spatial locations in the vessel. In contrast to the data obtained and the information calculated in the system described in the Sumanaweera patent, claim 1 recites that the blood flow data is calculated for location and *time*. Rather than calculating data having a time-component, the data obtained and the data calculated by the system described in the Sumanaweera patent is related to spatial location. For example, in constructing the 3D image of the vessel structure, the 2D image data frames are "inserted into their appropriate XYZ locations of the 3D volume as a function of the positional information." *See* col. 5, lines 18-21. With respect to vessel structure analysis, local gradients are determined from "the change in the ultrasound data values as a function of each of the x, y, and z dimensions." *See* col. 7, line 67-col. 8, line 6. the use of a x, y, z coordinate system suggests that the data and calculations are related to spatial locations. Calculating data for a plurality of locations along an ultrasound data and for a plurality of time intervals is not contemplated in the Sumanaweera patent.

The Examiner cites col. 4, lines 52-55 as disclosing a processor operable to "calculate blood flow data, including blood flow velocity data and detected Doppler signal power data, for a plurality of locations and for a plurality of time intervals." *See* the Office Action at page 2. The cited material, however, describes the rendering of a vessel by the 3D image processor 114 using data from different scan planes. The data can include Doppler velocity,

Doppler energy, Doppler variance, and B-mode data. *See* col. 4, lines 52-58. As explained in more detail later in the Sumanaweera patent, and as also previously discussed herein, the data from the different scan planes are not related to time, but are related to spatial location so that a 3D rendering of the vessel can be constructed and the structure analysis for different locations within the vessel can be determined. None of this, however, discusses calculating blood flow data for a plurality of locations along an ultrasound beam axis and for a plurality of *time intervals*.

Claims 7, 14, and 22 also include limitations similar to claim 1 that are not disclosed by the Sumanaweera patent. For example, claim 7 recites, in pertinent part, a Doppler ultrasound system that includes a processor operable to process detected reflected signals and calculate therefrom blood flow data for a plurality of locations at *a plurality of time intervals*. Claim 14 recites, in pertinent part, a Doppler ultrasound system including an ultrasound processor operable to process detected reflected signals and generate therefrom blood flow data for a plurality of locations *as a function of time*. Claim 22 recites, in pertinent part, a method for processing detected reflected signals including processing the detected reflected signals and calculating therefrom blood flow data for a plurality of locations along an ultrasound beam axis and for *a plurality of time intervals*. Each of these claims include limitations directed to a time element for the calculated blood flow data. As previously discussed with respect to claim 1, the Sumanaweera patent obtains or calculates data that is related to spatial location relative to the physiology of the vessel of interest. More specifically, the construction of the 3D image of the vessel is based on data from a 3D grid defining locations in a three-axis coordinate system and the structural analysis is based on data calculated as functions of spatial locations in an x, y, z coordinate system. The Sumanaweera patent fails to disclose including a time element in calculated blood flow data.

For the foregoing reasons, claims 1, 7, 14, and 22 are patentably distinct from the Sumanaweera patent. Claims 2-6, which depend from claim 1, claims 8-13, which depend from claim 7, claims 15-21, which depend from claim 14, and claims 23-28, which depend from claim 22, are similarly patentably distinct based on their dependency from a respective allowable base claim. That is, each of the dependent claims further narrows the scope of the claim from which it depends, and consequently, if a claim is dependent from an allowable base claim, the dependent

claim is also allowable. Therefore, the rejection of claims 1, 2, 7-9, 14-16, 19, 21-24, and 27 under 35 U.S.C. 102(e) should be withdrawn.

All of the claims pending in the present application are in condition for allowance. Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,

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